

Design and Performance of a 2-Dimensional Multi-Wire Neutron Detector with a Sensitive Area of $50 \times 50 \text{ cm}^2$ and a spatial resolution of $\sim 2 \times 2 \text{ mm}^2$

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Abstract

One two-dimensional position-sensitive multi-wire gaseous detector for reflectometry, small-angle neutron scattering (SANS) and high-resolution diffractometry has been developed at the GKSS research centre in co-operation with DENEX company. The counter with a sensitive area of $500 \times 500 \text{ mm}^2$ has been designed to be used in the reflectometer REFSANS being built at the new high flux reactor FRM-II [1, 2].

Tests of the detector electrodes as performed with an ^{55}Fe -source (floating ArCO_2 gas; detector closed with an X-ray transparent window) clearly reveal that their design and the delay line read-out allow of a position resolution higher than $2\text{mm} \times 2\text{mm}$. Tests with neutrons have been performed at the SANS-2 instrument at the Geesthacht Neutron Facility (GeNF) for which the detector was filled with 1 bar CF_4 and 0.8 bar ^3He . Excellent position resolution ($\sim 3\text{mm} \times 3\text{mm}$), high detection sensitivity ($\sim 58\%$ at 1.0 nm), high local count rates ($> 10^3 \text{ mm}^{-2} \text{ s}^{-1}$) and a very low sensitivity to γ -radiation ($\sim 3.0 \cdot 10^{-8}$ for 662 keV (^{137}Cs -source)) have been measured.

Subsequent to these tests the detector will be filled with ~ 2 bar CF_4 and 2 bar ^3He to allow of higher position resolution ($\sim 2\text{mm} \times 2\text{mm}$) as well as higher detection efficiency ($> 50\%$ for $\lambda > 0.25 \text{ nm}$). Due to its large area and its high resolution a detector of this kind might also be used required for diffractometry with thermal neutrons if the ^3He -partial pressure would be increased to achieve a high detection probability of more than 50% at e.g. $\lambda = 0.1 \text{ nm}$.

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[2] M. Marmotti, M. Haese-Seiller, R. Kampmann: Two-Dimensional Position-Sensitive Gaseous Detectors for High Resolution Neutron and X-Ray Diffraction, Proceedings of the International Conference on Neutron Scattering ICNS'01, , Appl. Phys. A 74[Suppl.] S252-S254 (2002).